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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/828,553	04/21/2004	Yasuhiro Ono	71025-011	5439

20277 7590 02/04/2008
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EXAMINER	
HALL, ASHA J	

ART UNIT	PAPER NUMBER
1795	

MAIL DATE	DELIVERY MODE
02/04/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/828,553	Applicant(s) ONO ET AL.	
	Examiner Asha Hall	Art Unit 1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *April 22, 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-43* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-43* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *See Continuation Sheet*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Continuation of Attachment(s) 3). Information Disclosure Statement(s) (PTO/SB/08), Paper No(s)/Mail Date :August 24, 2004 and November 22, 2004.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-10 are rejected under 35 U.S.C. 102(b) as being anticipated by Kamada et al. (US 2003/0034101).

With respect to claim 1, Kamada et al. discloses the thermoelectric conversion material (paragraph 4) comprising a half-Heusler alloy with components comprising of formula $QR(L_{1-p}Z_p)$, where Q is at least one element selected from group 5 elements, R is at least one element selected from cobalt, rhodium, and iridium, L is at least one element selected from tin and germanium, Z is at least one element selected from indium and antimony, and p is a numerical value that is equal to or greater than 0 and less than 0.5 (paragraph 39 & paragraphs 86-104).

In regards to claims 2-4, Kamada et al. discloses the thermoelectric conversion material according to claim 1, wherein p is greater than 0 and less than 0.5; p is greater than 0 and equal to or less than 0.05; p is greater than 0 and equal to or less than 0.02 (paragraph 86-104 & paragraph 146).

As to claims 5-8, Kamada et al. discloses the thermoelectric conversion material according to claim 1, wherein Q is niobium; R is cobalt; L is tin; p is greater than 0 and Z is antimony (paragraph 86-104 & paragraph 146).

In regard to claim 9 and 10, Kamada et al. the thermoelectric conversion material

according to claim 1, wherein Q is niobium, R is cobalt, L is tin, and p is 0 and wherein p is greater than 0, Q is niobium, R is cobalt, L is tin, and Z is antimony (paragraph 146, 148 & 149).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kamada et al. (US 2003/0034101) as applied to claim 1 above, and further in view of Hampl et al. (US 3,873,370).

As to claim 11, Kamada et al. discloses the thermoelectric conversion material according to claim 1, but fails to disclose wherein the half-Heusler alloy/composition presented above is made of single phase.

Hampl et al. discloses alloy thermoelectric conversion materials (col. 1; lines: 6-10) and further discloses a single phase alloy material that consists essentially of metal and nonmetal elements united in a distinct crystal lattice structure that is nonstoichiometric because of an excess or deficiency of atoms of at least he major metal element of the crystal lattice structure. This excess or deficiency of atoms provides current carriers needed for the composition that is beneficial for thermoelectric conversion (col. 1; lines: 35-51). It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate a single phase alloy as the thermoelectric conversion material as taught by Hampl to the thermoelectric conversion material

of Kamada et al. in order to provide an excess or deficiency of atoms provides current carriers needed for the composition that is beneficial for thermoelectric conversion.

5. Claims 12-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kamada et al. (US 2003/0034101) as applied to claim 1 above, and further in view of Kagawa et al. (US 5,969,290).

In regard to claims 12-14, Kamada et al. discloses the thermoelectric conversion element comprising a thermoelectric conversion material according to claim 1, but fails to disclose a first electrode and a second electrode connected to the thermoelectric conversion material, wherein a p-type thermoelectric conversion material connected to at least one of the first electrode and the second electrode, and further comprising an insulator connected to at least one of the first electrode and the second electrode.

Kagawa et al. discloses a thermoelectric conversion device (col. 9; lines: 1-5) and further discloses a first electrode and a second electrode connected to the thermoelectric conversion material as shown in Figure 15 (col. 9; lines: 10-20), wherein a p-type thermoelectric conversion material connected to at least one of the first electrode and the second electrode (col. 9; lines: 10-25), and further comprising an insulator connected to at least one of the first electrode and the second electrode (col. 19; lines: 14-15). Furthermore, Kagawa teaches that a temperature difference of both sides of the pair of p-type and n-type elements develops a potential difference there between, further if a current is passed through the junctions heat is absorbed or generated depending on the direction of the current (col. 1; lines: 13-20). It would have been obvious to

one of ordinary skill in the art at the time of the invention to incorporate a first and second electrode, a p-type thermoelectric material, and a insulator as taught by Kagawa et al. to the thermoelectric conversion elements/alloy of Kamada et al. in order to create a potential difference between the two thermoelectric materials, allowing for a current to pass through the junctions in which heat is absorbed or generated depending on the direction of the current.

As to claims 15-17, Kamada et al. discloses the thermoelectric conversion material according to claim 12, but fails to disclose thermoelectric conversion element comprising: n-type thermoelectric conversion materials and p-type thermoelectric

conversion materials, wherein: the n-type thermoelectric conversion materials and the p-type thermoelectric conversion materials are alternately and electrically connected in series, and at least one of the n-type thermoelectric conversion materials; wherein a DC power supply electrically connected to the thermoelectric conversion element and a load electrically connected to the thermoelectric conversion element and operated by a current supplied from the thermoelectric conversion element.

Kagawa et al. discloses a thermoelectric conversion device (col. 9; lines: 1-5) and further discloses a first electrode and a second electrode connected to the thermoelectric conversion material as shown in Figure 15 (col. 9; lines: 10-20), wherein a p-type and n-type thermoelectric conversion material are alternately connected in series (col. 9; lines: 10-25 & 53-56 & Figure 15). Kagawa further teaches that when the module is to be used as it is for connecting to a device/load are attached to the respective electrode plates serving as the base end and terminal end (implying a power supply sent the modules) of the electric series circuit (col. 9; lines: 61-65). Furthermore, Kagawa teaches that a temperature difference of both sides of the pair of p-

type and n-type elements develops a potential difference there between, further if a current is passed through the junctions heat is absorbed or generated depending on the direction of the current (col. 1; lines: 13-20). It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate a p-type and n-type thermoelectric material connected in series with a terminal end as taught by Kagawa et al. to the thermoelectric conversion elements/alloy of Kamada et al. in order to create a potential difference between the two thermoelectric materials, allowing for a current to pass through the junctions in which heat is absorbed or generated depending on the direction of the current.

6. Claims 18-27, 29-39, 40, 42, and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kamada et al. (US 2003/0034101), and in view of Kagawa et al. (US 5,969,290).

With respect to claims 18 and 31, Kamada et al. discloses the thermoelectric conversion material (paragraph 4) comprising a half-Heusler alloy with components comprising of formula $QR(L_{1-p}Z_p)$, where Q is at least one element selected from group 5 elements, R is at least one element selected from cobalt, rhodium, and iridium, L is at least one element selected from tin and germanium, Z is at least one element selected from indium and antimony, and p is a numerical value that is equal to or greater than 0 and less than 0.5 (paragraph 39 & paragraphs 86-104).

However, Kamada fails to disclose the method comprising a first electrode and a second electrode connected to the thermoelectric conversion material, wherein a p-type thermoelectric conversion material connected to at least one of the first electrode and the second electrode,

supplying heat so that a temperature difference is caused between the first and second electrode so as to produce s potential difference between the first and second electrode.

Kagawa et al. discloses a thermoelectric conversion device (col. 9; lines: 1-5) and further discloses a first electrode and a second electrode connected to the thermoelectric conversion material as shown in Figure 15 (col. 9; lines: 10-20), wherein a p-type thermoelectric conversion material connected to at least one of the first electrode and the second electrode (col. 9; lines: 10-25). Furthermore, Kagawa teaches that a temperature difference of both sides of the pair of p-type and n-type elements develops a potential difference there between, further if a current is passed through the junctions heat is absorbed or generated depending on the direction of the current (col. 1; lines: 13-20). It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate a first and second electrode and a p-type thermoelectric material as taught by Kagawa et al. to the thermoelectric conversion elements/alloy of Kamada et al. in order to create a potential difference between the two thermoelectric materials, allowing for a current to pass through the junctions in which heat is absorbed or generated depending on the direction of the current.

In regards to claims 19-21, modified Kamada et al. discloses the method of generating electric power according to claim 18, wherein p is greater than 0 and less than 0.5; p is greater than 0 and equal to or less than 0.05; p is greater than 0 and equal to or less than 0.02 (paragraph 86-104 & paragraph 146).

As to claims 22-25, modified Kamada et al. discloses the method of generating electric power according to claim 18, wherein Q is niobium; R is cobalt; L is tin; p is greater than 0 and Z is antimony (paragraph 86-104 & paragraph 146).

In regard to claims 26 and 27, modified Kamada et al. the method of generating electric power according to claim 18, wherein Q is niobium, R is cobalt, L is tin, and p is 0 and wherein p is greater than 0, Q is niobium, R is cobalt, L is tin, and Z is antimony (paragraph 146, 148 & 149).

In regard to claims 29, 30, 42, and 43, modified Kamada et al. discloses the method of generating electric power according to claim 18 and the cooling method according to claim 31, but fails to disclose a first electrode and a second electrode connected to the thermoelectric conversion material, wherein a p-type thermoelectric conversion material connected to at least one of the first electrode and the second electrode, and further comprising an insulator connected to at least one of the first electrode and the second electrode.

Kagawa et al. discloses a thermoelectric conversion device (col. 9; lines: 1-5) and further discloses a first electrode and a second electrode connected to the thermoelectric conversion material as shown in Figure 15 (col. 9; lines: 10-20), wherein a p-type thermoelectric conversion material connected to at least one of the first electrode and the second electrode (col. 9; lines: 10-25), and further comprising an insulator connected to at least one of the first electrode and the second electrode (col. 19; lines: 14-15). Furthermore, Kagawa teaches that a temperature difference of both sides of the pair of p-type and n-type elements develops a potential difference there between, further if a current is passed through the junctions heat is absorbed or generated depending on the direction of the current (col. 1; lines: 13-20). It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate a first and second electrode, a p-type thermoelectric material, and a insulator as taught by Kagawa et al. to the thermoelectric conversion elements/alloy of modified Kamada et al. in order to create a potential

difference between the two thermoelectric materials, allowing for a current to pass through the junctions in which heat is absorbed or generated depending on the direction of the current.

In regards to claims 32-34, modified Kamada et al. discloses the cooling method according to claim 31, wherein p is greater than 0 and less than 0.5; p is greater than 0 and equal to or less than 0.05; p is greater than 0 and equal to or less than 0.02 (paragraph 86-104 & paragraph 146).

As to claims 35-38, modified Kamada et al. discloses the cooling method according to claim 31, wherein Q is niobium; R is cobalt; L is tin; p is greater than 0 and Z is antimony (paragraph 86-104 & paragraph 146).

In regard to claim 39 and 40, modified Kamada et al. discloses the cooling method according to claim 31, wherein Q is niobium, R is cobalt, L is tin, and p is 0 and wherein p is greater than 0, Q is niobium, R is cobalt, L is tin, and Z is antimony (paragraph 146, 148 & 149).

7. Claims 28 and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kamada et al. (US 2003/0034101) and Kagawa et al. (US 5,969290 as applied to the above claims 18 and 31 respectively, and further in view of Hampl et al. (US 3,873,370).

As to claims 28 and 41, modified Kamada et al. discloses the method of generating electric power according to claim 18 and the cooling method according to claim 31, but fails to disclose wherein the half-Heusler alloy/composition presented above is made of single phase.

Hampl et al. discloses alloy thermoelectric conversion materials (col. 1; lines: 6-10) and further discloses a single phase alloy material that consists essentially of metal and nonmetal elements united in a distinct crystal lattice structure that is nonstoichiometric because of an excess or deficiency of atoms of at least he major metal element of the crystal lattice structure.

This excess or deficiency of atoms provides current carriers needed for the composition that is beneficial for thermoelectric conversion (col. 1; lines: 35-51). It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate a single phase alloy as the thermoelectric conversion material as taught by Hampl to the thermoelectric conversion material of modified Kamada et al. in order to provide an excess or deficiency of atoms provides current carriers needed for the composition that is beneficial for thermoelectric conversion.

Conclusion

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Asha Hall whose telephone number is 571-272-9812. The examiner can normally be reached on Monday-Thursday 8:30-7:00PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexa Neckel can be reached on 571-272-1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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Alexa Neckel
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